HIGHLY IONIZED NEON IN THE SPECTRUM OF THE SEY 2 GALAXY NGC 4507 ?

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ABSTRACT. Results of an ASCA X-ray observation of NGC 4507 are presented. The spectrum is best parameterized by a double power law (or a partial covering) model plus a narrow FeKα emission line likely due to the line-of-sight absorption matter. The data require also an emission line at ~ 0.9 keV consistent with NeIX, which may indicate that the soft X-ray emission derives from a combination of resonant scattering and fluorescence of the radiation by photoionized gas. Moreover, complex absorption (or other, unresolved, emission lines) is required by the data below 3 keV. Similarities between the X-ray spectra of NGC 4507 and NGC 4151 are also stressed.

1. NGC 4507: spectral analysis

NGC 4507, a highly absorbed Sey 2 galaxy (z=0.012), was observed with the gas imaging spectrometer (GIS) and solid state spectrometer (SIS) on board the ASCA satellite (Tanaka et al. 1994) in February 1994. After applying standard selection criteria, 25 Ks for each SIS and 40 Ks for the GIS2 detector were collected.

Previous analisies showed a complex X-ray spectrum. Ginga observation revealed a hard power law ($\Gamma_{2-20\rm keV} \sim 1.4\pm0.2$), a high column density ($N_{\rm H} \sim 3.7\pm0.5 \times 10^{23}$ cm^{-2}) and an iron emission line (EW $\sim 400\pm100$ eV) (Awaki et al. 1991), while OSSE observation (Bassani et al. 1995) showed a photon index $\Gamma \sim 2.1\pm0.3$ in agreement with those of Seyfert galaxies in the same energy range (Johnson et al. 1993). The ASCA data require at least a double power law (or partial covering) model plus a narrow FeKα line, whose rest energy indicates emission from neutral matter. The relevant data are listed in table 1. Moreover, from the spectrum below 1 keV there is evidence for a soft narrow emission line at ~ 0.9 keV (fig. 1). When it is fitted to the data, the improvement is significant ($\Delta\chi^2 \sim 14$ with the addition of 2 dof). The line energy is consistent with NeIX (E ~ 0.92 keV, fig. 1) and may be produced in photoionized gas (i.e. which may be identified with the warm absorber observed in Sey 1 galaxies) with contributions from both the resonant scattering and fluorescent lines. The equivalent widths (EW) of the two components depends strongly on the optical depth of the emitting matter. The total observed value (i.e about 100 eV) suggests that the matter is completely thick to resonant absorption and mildly thick to fluorescence, a situation which is realized if the

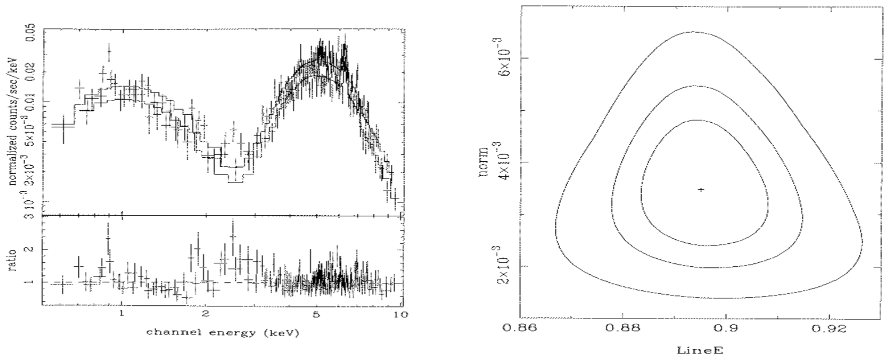

Fig. 1. NGC 4507: ASCA spectrum; energy vs. intensity conf. cont. for the NeIX line.

equivalent hydrogen column density of the matter is of the order of $10^{22 \div 23}$ cm^{-2}, the exact value depending on geometrical and physical parameters. It is worth noting that a similar estimate can be independently derived from the ratio of the scattered and direct continua, which is about 1%.

The evidence for some residuals in the spectrum below 3 keV suggests complex absorption of the nuclear radiation, e.g. a dual absorber, with the second absorbing matter possibly ionized. It is interesting to note that NGC 4507 shows strong similarities with NGC 4151 (Leighly et al., in preparation). In both sources a "soft" narrow line clearly improves the fit and the residuals indicate complex absorption below $\sim$ 3 keV. Soft emission lines have probably been detected by ASCA in other Seyferts like Mkn 3 (Iwasawa et al. 1994), NGC 4051 (Guainazzi et al. in press) and NGC 4388 (Iwasawa et al. in press), but further investigations are needed to fully understand the nature of the soft X-ray emission.

Tab. 1 - Spectral parameters

NGC 4507							
model	Γ_1	$E_{\rm Ne}$	$EW_{\rm Ne}$	$N_{\rm H}$	Γ_2	$E_{K\alpha}$	$EW_{K\alpha}$
po+po	$2.34^{+0.25}_{-0.20}$	....	......	$3.10^{+0.37}_{-0.35}\times10^{23}$	$1.80^{+0.21}_{-0.22}$	$6.36^{+0.02}_{-0.03}$	177^{+47}_{-40}
po+po+Ne	$2.07^{+0.24}_{-0.22}$	0.90±0.03	117^{+49}_{-47}	”	”	”	”

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